the external magnetic field.

Because the tricritical point occurs at zero staggered field, it would not be observed in the Brookhaven experiment, Blume explained. Instead they see a wing critical point, which means that the system is critical along the wings in the tricritical diagram. Such a wing critical point has not been observed before, Blume told us.

The Brookhaven–Stony Brook group expects that DAG will show a tricritical point when the magnetic field is applied along a different crystalline direction. They plan to investigate the other directions in the future.

Further evidence of unusual magnetic behavior in DAG was presented by Joseph F. Dillon Jr and Edward Yi Chen (Bell Labs), Nick Giordano and Wolf (Yale) in mid-April at the Conference on Critical Phenomena in Multicomponent Systems held at the University of Georgia. In a series of magneto-optical experiments they showed that DAG displays a peculiar hysteresis. This hysteresis is a further manifestation of the coupling between an applied field and the staggered magnetization, they say. The two normally indistinguishable time-reversed antiferromagnetic states (up–down and down–up) are inequivalent in a magnetic field, the group explained. These workers also proposed a microscopic mechanism that accounts for the magnitude of the observed effects.

—GBL

Nucleon–nucleon correlations in p–He^4?

A recent experiment at Saclay suggests that to explain the behavior of 1-GeV protons elastically scattering off He^4 it is necessary to include the effect of correlations between the nucleons. When we recently visited Jacques Thirion at Saclay he told us of the results, which have just been reported in the 15 April issue of *Phys. Rev. Letters*. Herman Feshbach (MIT) has found that the explanation of the Saclay results would require the inclusion of nucleon–nucleon correlations in the nuclear wave function.

The Saclay results[1] are in disagreement with an earlier experiment, done in 1967 by Harry Palevsky and his collaborators,[2] who used the Brookhaven Cosmotron for a series of pioneering experiments just before the machine was shut down permanently. Although high-energy electrons have been used as nuclear probes, the Cosmotron experiment was the first to do the same with high-energy protons. The Brookhaven collaboration studied 1-GeV protons striking hydrogen, deuterium, helium, Li^6, carbon, oxygen and lead. Energy resolution was about 3 MeV and angular resolution was ±0.1 deg.

The Saclay experimenters used 1.05-GeV protons from the weak-focusing synchrotron, Saturne; plans are afoot to convert this machine into a strong-focusing synchrotron to be used exclusively for nuclear-physics experiments (PHYSICS TODAY, April, page 121). Measurements on proton–He^4 scattering were done from 3–47 deg in the laboratory system. The experimenters, Stephen Baker (now at Rice University), R. Beurtey, A. Chaumeaux, J.-M. Durand, J.-C. Faivre, J.-M. Fontaine, D. Garreta, D. Legrand, J. Saudinos and Thirion (all of Saclay), and R. Bertini, F. Brochard and F. Hibou (all of Centre de Recherche Nucléaire de Strasbourg), used the magnetic spectrometer facility known as SPES 1. Their target was a liquid-helium layer 20 cm in diameter and 1 cm thick that was kept perpendicular to the beam between Mylar sheets in a thin-walled dewar system. The spectrometer is used in an energy-loss mode, in which the dispersion and focusing properties of the analyzing magnet system in addition to the effects of scattering kinematics are matched to the properties of the spectrometer magnet system. They reported a resolution from 300 keV to 2 MeV (FWHM), depending on the scattering angle. The angular resolution (FWHM), they say, is 9 milliradians for scattering angles less than 26 deg in the lab, increasing monotonically to 21 milliradians at 44 deg in the lab.

The Saclay–Strasbourg workers find themselves in good agreement with the Brookhaven group at small angles, but in rather serious disagreement in the vicinity of the first minimum (see figure), which in the Saclay experiments is largely filled in.

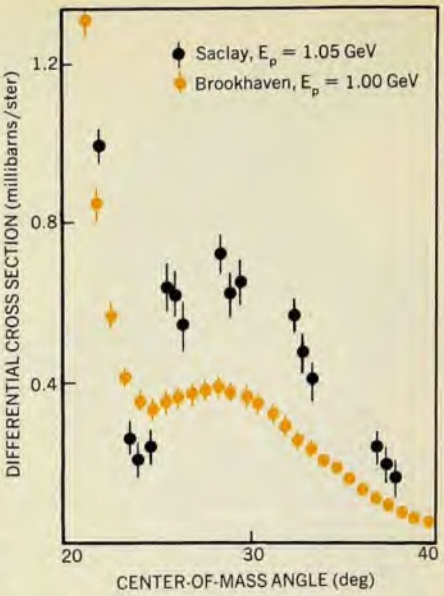
The Saclay experimenters have also done[3] both elastic and inelastic scattering with Li^6, C^{12}, O^{16}, Ni^{58} and Pb^{208}. There is no significant disagreement between Saclay and Brookhaven results other than for the helium.

Theory. Nuclear physicists have been trying to get a handle on what the short-range correlations are among nucleons. There has been little direct evidence for this effect. It has not yet been seen unambiguously in scattering with high-energy electrons. Another source of information may come from intermediate-energy pions scattering off nuclei. Feshbach told us that he feels that until now, it was difficult to make any definitive statements, partly because the characteristic angular distribution forms a simple diffraction pattern.

In the high-energy approximation, which can be used as soon as you reach several hundred MeV (the exact figure depends on the theorist), because the wavelength is very small, one can calculate the scattering from a series for the optical potential. The first term has no correlation, the second term has a pair correlation, and so on. Feshbach feels that if the Saclay experiment on helium is correct, one must have at least a pair-correlation term. This implies that the nuclear wave function must have, besides binding energy, magnetic moment (although not for He^4), and a spectrum of excited states, the property of pair correlations.

Feshbach is also excited about the Saclay results for the heavy nuclei because they point the way to the eventual measurement of the distribution of protons and neutrons inside the nucleus. He and Elie Boridey are doing an optical-model calculation for the heavy nuclei without correlations, and they are getting excellent agreement with the angular distributions observed by the Saclay group.

—GBL



Angular distribution for 1-GeV protons striking He^4. The Saclay experimenters do not find the deep minimum reported in the earlier Brookhaven Cosmotron experiments.

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